

CLAIMS

1. A method for modifying plant growth and/or yield or modifying architecture comprising introducing into a plant cell, plant tissue or plant (a) nucleic acid molecule(s) or regulatory sequence(s), wherein the introduction of the nucleic acid molecule(s) or regulatory sequence(s) result(s) in an increased or de novo expression of at least two cell cycle interacting proteins capable of forming a (heteromeric) complex in a plant cell.
2. The method of claim 1, wherein said nucleic acid molecule(s) encode(s) said cell cycle interacting protein(s) and the regulatory sequence(s) is (are) capable of increasing the expression of a gene encoding said cell cycle interacting protein(s).
3. The method of claim 1 or 2, wherein one of said cell cycle interacting proteins is a protein kinase.
4. ~~The method of any one of claims 1 to 3, wherein said protein kinase is a cycline-dependent kinase (CDK).~~
5. The method of claim 4, wherein said CDK is an A-type or a B-type CDK.
6. ~~The method of claim 4 or 5, wherein said CDK is a PSTAIRE type CDK.~~
7. The method of claim 5, wherein the A-type CDK is Cdc2a and B-type CDK is Cdc2b.
8. ~~The method of any one of claims 1 to 7, wherein one of said cell cycle interacting proteins is a cyclin (Cyc).~~

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9. The method of claim 8, wherein the cyclin is a G1 cyclin.
10. ~~The method of claim 8 or 9, wherein the cyclin is A, B, C, D or E-type cyclin.~~
- Sub A4 > 11. The method of any one of claims 8 to 10, wherein the cyclin is a CycA1;1, CycA2;1, CycA2;2, CycA2;3, CycA3;1, CycB1;1, CycB1;2, CycB2;1, CycB2;2, CycD1;1, CycD2;1, CycD3;1 or CycD4;1.
12. The method of claim 11, wherein the cyclin is CycD4;1.
- Sub A5 > 13. ~~The method of any one of claims 1 to 12, wherein one of the cell cycle interacting proteins is a ORC1, CDC6, CDC7, DBF4, E2F or DP.~~
14. The method of claim 13, wherein
- (a) one cell cycle interacting protein is ORC1 and one is CDC 6;
 - (b) one cell cycle interacting protein is DBF4 and one is CDC 7;
 - (c) one cell cycle interacting protein is E2F and one is DP.
- Sub A6 > 15. ~~The method of any one of claims 1 to 12, wherein one cell cycle interacting protein is a CDK and one of said cell cycle interactive proteins is a cyclin.~~
16. The method of claim 15, wherein
- (a) the CDK is a A-type CDK and the cyclin is a B-type cyclin;
 - (b) the CDK is a B-type CDK and the cyclin is a B-type cyclin;
 - (c) the CDK is a A-type CDK and the cyclin is a D-type cyclin; or
 - (d) the CDK is a B-type CDK and the cyclin is a A-type cyclin.
- Sub A7 > 17. ~~The method of claim 15 or 16, wherein~~
- (a) ~~the cyclin is CycA2;1 and the CDK is Cdc2a;~~
 - (b) ~~the cyclin is CycA2;2 and the CDK is Cdc2a, Cdc2b, Cdc2f, Cdc2bN161 or Cdc2aN146;~~

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- (c) the cyclin is CycA2;3 and the CDK is Cdc2b, Cdc2f, Cdc2bN161 or Cdc2aN146;
 - (d) the cyclin is CycB1;1 and the CDK is Cdc2a or Cdc2b;
 - (e) the cyclin is CycB1;2 and the CDK is Cdc2a or Cdc2b;
 - (f) the cyclin is CycB2;1 and the CDK is Cdc2b or Cdc2f;
 - (g) the cyclin is CycB2;2 and the CDK is Cdc2a or Cdc2b;
 - (h) the cyclin is CycD1;1 and the CDK is G1-CDK or Cdc2a;
 - (i) the cyclin is CycD2;1 and the CDK is G1-CDK or Cdc2a;
 - (j) the cyclin is CycD3;1 and the CDK is G1-CDK or Cdc2a; or
 - (k) the cyclin is CycD4;1 and the CDK is Cdc2a, Cdc2b, Cdc2f, Cdc2bN161, Cdc2aN146 or Cdc2fN164.

- 18. The method of any one of claims 1 to 17 wherein the CDK is Cdc2a and the cyclin is CycD4;1.
- 19. The method of anyone of claims 1 to 18, wherein the cell cycle interacting protein is a modified, a homolog or an analog form of a cell cycle interacting protein.
- 20. The method of any one of claims 1 to 19, wherein said nucleic acid molecule(s) encode(s) at least a catalytic and/or regulatory subunit of said cell cycle interacting protein(s).
- 21. The method of any one of claims 1 to 20, wherein said cell cycle interacting proteins are expressed in one or more particular plant cells, tissues, organs and plant parts and progeny plants.
- 22. The method of any one of claims 1 to 21, wherein said nucleic acid molecule(s) is (are) operatively linked to regulatory sequences allowing the expression of the nucleic acid molecule(s) in the plant cell.

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23. The method of any one of claims 1 to 22, wherein the regulatory sequence comprises promoter, enhancer, silencer, intron sequences, 3'UTR and/or 5'UTR regions, protein and/or RNA stabilizing elements.
 24. The method of any one of claims 1 to 23, wherein said regulatory sequence is a chimeric, tissue specific, constitutive or inducible promotor.
 25. The method of any one of claims 1 to 24, wherein said plant is a monocotyledonous or a dicotyledonous plant.
 26. The method of any one of claims 1 to 25 wherein said plant is a crop plant, root plant, oil producing plant, wood producing plant, agricultured biocultured plant, fodder or forage legume, companion plant or horticultured plant.
 27. The method of claim 25 or 26, wherein said plant is wheat, barley, maize, rice, carrot, sugar beet, cichorei, cotton, sunflower, tomato, cassava, grapes, soybean, sugar cane, flax, oilseed rape, tea, canola, onion, asparagus, carrot, celery, cabbage, lentil, broccoli, cauliflower, brussel sprout, artichoke, okra, squash, kale, collard greens or potato.
 28. A nucleic acid molecule encoding at least two cell cycle interacting proteins as defined in any one of claims 1 to 21.
 29. A vector comprising the nucleic acid molecule of claim 28 or at least two nucleic acid molecules and/or regulatory sequences as defined in any one of claims 1 to 21.
 30. The vector of claim 29 comprising separate nucleic acid molecules encoding at least one of said cell cycle interacting proteins as defined in any one of claims 1 to 21.

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31. A composition comprising vectors wherein each vector contains at least one nucleic acid molecule encoding at least one cell cycle interacting protein as defined in any one of claims 1 to 21; and wherein the expression of said vectors results in the production of at least two cell cycle interacting proteins and assembly of the same in a complex in vitro or in vivo.
32. The vector of claim 29 or 30 or the composition of claim 31 wherein the nucleic acid molecule is operatively linked to (a) control sequence(s) allowing the expression of cell cycle interacting proteins in a host cell.
33. The vector or composition of claim 32 wherein said control sequence is a constitutive, chimeric, tissue specific or inducible promoter.
34. A host cell comprising the nucleic acid molecule of claim 28, the vector of any one of claims 29, 30, 32 or 33, or the composition of claims 31 or 32.
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35. A method for the preparation of a cell cycle protein complex comprising:
(a) culturing the host cell of claim 34 under conditions suitable for the expression of the nucleic acid molecules; and
(b) recovering the complex from the culture.
36. A cell cycle protein complex obtainable by the method of claim 35 or encodable by the nucleic acid molecule of claim 28.
37. A transgenic plant cell displaying an increased amount of or de novo cell cycle interacting protein complex compared to a corresponding wild type plant cell said transgenic plant cell comprising at least one nucleic acid molecule or regulatory sequence as defined in any one of claim 1 to 21, a nucleic acid molecule of claim 28, the vector of any one of claims 29, 30, 32 or 33 or the vectors of the composition of claim 31 or 32 or obtainable by the method of any one of claims 1 to 27.

38. The transgenic plant cell of claim 37 which displays an increased cell division rate.
39. A transgenic plant or plant tissue comprising plant cells of claim 37 or 38 or obtainable by the method of any one of claims 1 to 27.
40. The transgenic plant of claim 39 which displays modified and/or accelerated and/or enhanced plant growth, root growth, shoot growth and/or yield or modified architecture compared to the corresponding wild type plant.
41. Harvestable parts or propagation material of a plant of claim 29 or 30 comprising the plant cell of claim 37 or 38 or the tissue of claim 39.
42. Use of at least one nucleic acid molecule or regulatory sequence as defined in any one of claims 1 to 21 or a nucleic acid molecule of claim 28, the vector of any one of claims 29, 30, 32 or 33 or the vectors of the composition of claim 31 or 32 for increasing cell division rates in plants, plant cells or plant tissue.
43. The use of claim 42, wherein said increased cell division rates result in increased or enhanced biomass, plant growth, root and/or shoot growth, seed setting, seed set, seed production, grain yield, yield of harvestable material, modified architecture, fruit size, nitrogen-fixing capability, nodule size, stem thickness, endosperm size, number of fruits per plant and/or initiation, promotion, stimulation or enhancement of seed development, tuber formation, shoot initiation, leaf initiation, inhibition of apical dominance and/or development.
44. A composition comprising nucleic acid molecules or regulatory sequences as defined in any one of claims 1 to 21, a nucleic acid molecule of claim 28, the vector of any one of claims 29, 30, 32 or 33,

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the plant cells of claim 37 or 38, the tissue of claim 38 or the vectors of the composition of claim 31 or 32.

45. Use of at least one nucleic acid molecule or regulatory sequence as defined in any one of claims 1 to 21 or a nucleic acid molecule of claim 28, the vector of any one of claims 29, 30, 32 or 33 or the vectors of the composition of claims 31 or 32, the tissue of claim 39 or the plant cells of claim 37 or 38 for the production of more biomass, of secondary metabolites or additives for plant culturing in plant cell culture.